EXRADIN®

MAGNA A600 / A650

Ionization Chambers

REF 92600 / 92650

Standard Imaging®

User Manual

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Ionization Chambers

REF 92600 / 92650

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General Precautions

Warnings and Cautions alert users to dangerous conditions that can occur if instructions in the manual are not obeyed. Warnings are conditions that can cause injury to the operator, while Cautions can cause damage to the equipment.

WARNING:
Exradin Ion Chambers are intended for quality assurance and calibration measurements. They are not intended to be connected to a patient for real-time dosimetry measurements.

CAUTION:
Proper use of this device depends on careful reading of all instructions and labels.

CAUTION:
This device should never be submerged to clean or scrubbed with an abrasive cleaner.

CAUTION:
Do not drop or mishandle unit. Calibration factor changes may result.

CAUTION:
Electrical shock hazard when connected to 300 V bias supply. Do not remove cover.

CAUTION:
Do not disassemble main unit since it may result in change of calibration factor. Refer all servicing to qualified individuals.

CAUTION:
Do not sharply bend triax cable. Damage to the cable may result in high leakage currents.

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Overview

The Exradin MAGNA Ion Chambers are parallel-plate ionization chambers. They are specifically designed for use with both mammography and general diagnostic energy x-ray regions, with the appropriate calibration. The nominal calibration factor for various applications using the MAGNA A600 1cc chamber (REF 92600) is 3 R/nC ± 3% and the MAGNA A650 3cc chamber (REF 92650) is 9 R/nC ± 3% over the entire diagnostic range; it is within ± 1% between the half value layers of 0.2 mm Al to 0.5 mm Al, which is the mammographic range. Mammography dose calculations and half value layer measurements depend on accurate exposure calibrations. It is recommended that the chamber be calibrated every two years as is standard practice for other ionization chambers. Calibration factors should be obtained from an ADCL for each x-ray energy that is being measured. The appendix provided with the ADCL calibration report discusses the calibration factors in greater detail. The measurement of all x-ray energies requires an electrometer with a calibrated scale for measuring charges of 0.5 nC.

A typical energy response curve for the MAGNA ionization chamber is shown in **Figure 1**. The MAGNA utilizes a conventional triax connector and cable to be connected to a suitable electrometer. A bias of 300 volts must be applied to the electrometer low-impedance connection relative to chassis ground. The voltage polarity effect is less than 0.1%. A second bias level of 150 volts can also be used to determine the ionic recombination loss at 300 V. [1] The ionic recombination loss is less than 0.05% and can be considered negligible. The MAGNA ionization chamber has a vent hole to maintain the internal air at ambient atmospheric pressure. Thus, the readings obtained must be corrected for ambient temperature and pressure to the temperature and pressure of calibration (22° C and 760 mm Hg) at "normal" relative humidity (50%+/-25% non-condensing) in the usual accepted manner.

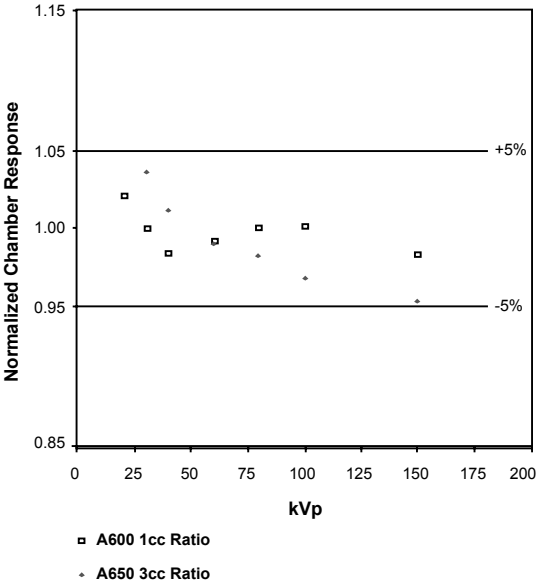

Figure 1: Typical energy response shown for the energy range 20 kVp to 150kVp.

Mammography X-Ray Measurement

1. Place the MAGNA chamber in the same room as the mammography unit for at least 30 minutes before the measurement to allow it to equilibrate to ambient temperature and pressure.

2. Connect the MAGNA chamber to a suitable electrometer, and apply 300 V bias voltage.

3. Place the MAGNA into a suitable holder (foam insert in MAGNA box can be used to place ion chamber front surface at 4.5 cm height from receptor.

4. Set mammography unit for typical exposure and expose for a series of measurements.

5. Read and record the measured charge for each exposure. The readings can be averaged.

6. Use correction factors for temperature/pressure, electrometer correction factor (electrometer must be calibrated) and calibration factor for the MAGNA given by the Accredited Dosimetry Calibration Laboratory to calculate the exposure for the time set on the x-ray unit. The following equation can be used:

$$\mathbf{X = R * F * E * C}$$

where:
X = the exposure using the calibration factor provided by the ADCL
R = the reading in coulombs (note that this charge is measured for a set time on the x-ray unit).
F = the temperature and pressure correction factor
E = the correction factor for the electrometer scale
C = the MAGNA calibration factor

NOTE: R can be divided by A_{ion} if desired to correct for recombination effects. Since the MAGNA has an A_{ion} of 1.000, this is not necessary.

Assume:

R = 0.21 nC **E** = 0.999
F = 1.021 **C** = 2.1 R/nC

then:

$$\mathbf{X = (2.14 \times 10^{-9}) * (1.021) * (0.999) * (2.1 \times 10^{9}) = 0.45\ R\ (450\ mR)}$$

Diagnostic X-Ray Measurement

1. Place the MAGNA chamber in the same room as the x-ray unit for at least 30 minutes before the measurement to allow it to equilibrate to ambient temperature and pressure.

2. Connect MAGNA chamber to a suitable electrometer and apply 300 V bias voltage.

3. Position the MAGNA chamber at the appropriate distance to be measured using the line around outer ring which shows the center of the active volume.

4. Set the x-ray unit for typical exposure and expose for a series of measurements.

5. Read and record the measured charge for each exposure. The readings can be averaged.

6. Use correction factor for temperature/pressure, electrometer correction factor (electrometer must be calibrated) and calibration factor for the MAGNA given by the Accredited Dosimetry Calibration Laboratory to calculate the activity of the given source. The following equation can be used:

$$X = R * F * E * C$$

where:

X = the exposure using the calibration factor provided by the ADCL.
R = the reading in coulombs (note that this charge is measured for a set time on the x-ray unit).
F = the temperature and pressure correction factor
E = the correction factor for the electrometer scale
C = the MAGNA calibration factor

NOTE: X can be divided by A_{ion} if desired to correct for recombination effects. Since the MAGNA has an A_{ion} of 1.000, this is not necessary. Again the example as given above in A6 with the appropriate values of R, F, E, and C is applicable.

Calibration

As is standard practice for other ion chambers, it is recommended that the MAGNA be calibrated every 2 years. This calibration should be performed by an Accredited Dosimetry Calibration Laboratory. Standard Imaging offers calibrations from the University of Wisconsin Accredited Dosimetry Calibration Laboratory. You need only one purchase order to cover calibrations, shipping and handling, and service. Standard Imaging hand carries all instruments to and from the ADCL.

Parts and Accessories

REF	Description
70004	10 meter triaxial extension cable with two lug triax connectors: Other lengths upon request
72152	Triax BNC Jack (F/M) in place of standard Triax BNC Plug (M/F)
72153	Triax TNC Plug (M/F) in place of standard Triax BNC Plug (M/F)
72154	Triax TNC Jack (F/M) in place of standard Triax BNC Plug (M/F)
72155	Coax BNC Plug (M/F) with banana plug (M) in place of standard Triax BNC
72156	Coax BNC Jack (F/M) with banana jack (F) in place of standard Triax BNC
72157	Triax LEMO in place of standard Triax BNC Plug (M/F)
80028	MAGNA Instruction Manual
80050	Chamber Calibration for one energy
72003	Carrying case
92600	Exradin MAGNA A600 1cc Ion Chamber
92650	Exradin MAGNA A650 3cc Ion Chamber
90001	
80015	EXCALIBUR CDX-2000B Electrometer Electrometer calibration, Amp and Coulomb scales

Features and Specifications

Active Volume:	A600 Chamber: 1 cm^3 A650 Chamber: 3 cm^3
Materials:	Air equivalent plastic, acrylic
Entrance window:	Kapton conductive film
Connector:	Two lug triax (standard) Center pin = Collector Inner Guard = Chamber Guard Outer Housing = HV GND
Cable Length:	1 m (39.4 inches)
Bias Voltage:	Normal operation at +/-300 Vdc
Leakage Current:	Less than 5 x 10^{-14} A
Reference Point:	Scribed line around circumference of the outer ring is half way between the collector and the entry window.
Accuracy:	+/- 1.0 %
Stability:	0.2%
Response:	**92600:** Flat response over 30kVp to 150kVp ± 2% **92650:** Flat response over 30kVp to 150kVp ± 4%
Calibration response: (typical)	A600: 3 R / nC A650: 9 R / nC
A_{ion} (typical):	1.000

Chamber Dimensions	**92600**	**92650**
Height	2.54 cm	2.08 cm
Outside Diameter	4.13 cm	5.33 cm
Inner Plate separation	8 mm	8 mm
Weight	0.2 kg	0.2 kg

Product Standards:	IEC 60601-1_1, IEC 61674$_1$ CE 0413

[1] Designed to Meet

Service Notes

Since this is a precision piece of equipment, it is recommended that Standard Imaging be contacted to discuss any significant problem with this chamber. The entrance window of the MAGNA is fragile; cleaning should be accomplished by blowing with air only. Exterior cleaning of the remainder of the device can be done with a soft brush and a cloth. Gently brush all surfaces to remove dirt and dust. Remove any remaining dirt with a cloth slightly dampened with a solution of mild detergent and water or a liquid disinfecting agent. Be especially careful that this is an external cleaning only and do not permit any liquid to seep into the MAGNA in any manner during cleaning.

Service and Maintenance

There are no user-serviceable parts within this ionization chamber. Under no circumstance should the user attempt to repair or disassemble the chamber and/or connector, as the warranty will become void and the calibration factor will change. Under normal use, the chambers should provide years of trouble-free service.

If assistance is desired in the proper disposal of this product (including accessories and components), after its useful life, please return to Standard Imaging.

Service Policy

If service, including recalibration, is required, please contact Standard Imaging's Customer Service department by phone or email prior to shipping the product. Standard Imaging's Customer Service and Technical Service staff will attempt to address the product issue via phone or email. If unable to address the issue, a return material authorization (RMA) number will be issued. With the RMA number, the product can be returned to Standard Imaging. It is the responsibility of the customer to properly package, insure and ship the product, with the RMA number clearly identified on the outside of the package. The customer must immediately file a claim with their carrier for any shipping damage or lost shipments. Return shipping and insurance is to be pre-paid or billed to the customer, and the customer may request a specific shipper. Items found to be out of warranty are subject to a minimum service fee of 1 hour labor (excluding recalibrations) for diagnostic efforts and require a purchase order (PO) before service is performed. With concurrence from customer, the product may be replaced if it is unserviceable or if the required service is cost prohibitive. Products incurring service charges may be held for payment. Standard Imaging does not provide loaner products. See the Standard Imaging Warranty and Customer Responsibility for additional information.

Customer Responsibility

This product and its components will perform properly and reliably only when operated and maintained in accordance with the instructions contained in this manual and accompanying labels. A defective device should not be used. Parts which may be broken or missing or are clearly worn, distorted or contaminated should be replaced immediately with genuine replacement parts manufactured by or made available from Standard Imaging Inc.

CAUTION: Federal law in the U.S.A. and Canadian law restrict the sale, distribution, or use of this product to, by, or on the order of a licensed medical practitioner. The use of this product should be restricted to the supervision of a qualified medical physicist. Measurement of high activity radioactive sources is potentially hazardous and should be performed by qualified personnel.

Should repair or replacement of this product become necessary after the warranty period, the customer should seek advice from Standard Imaging Inc. prior to such repair or replacement. If this product is in need of repair, it should not be used until all repairs have been made and the product is functioning properly and ready for use. After repair, the product may need to be calibrated. The owner of this product has sole responsibility for any malfunction resulting from abuse, improper use or maintenance, or repair by anyone other than Standard Imaging Inc.

The information in this manual is subject to change without notice. No part of this manual may be copied or reproduced in any form or by any means without prior written consent of Standard Imaging Inc.

Warranty

Standard Imaging, Inc. sells this product under the warranty herein set forth. The warranty is extended only to the buyer purchasing the product directly from Standard Imaging, Inc. or as a new product from an authorized dealer or distributor of Standard Imaging, Inc.

For a period provided in the table below from the date of original delivery to the purchaser or a distributor, this Standard Imaging, Inc. product, provided in the table is warranted against functional defects in design, materials and workmanship, provided it is properly operated under conditions of normal use, and that repairs and replacements are made in accordance herewith. The foregoing warranty shall not apply if the product has been altered, disassembled or repaired other than by Standard Imaging, Inc. or if the product has been subject to abuse, misuse, negligence or accident.

Product	Warranty Period
Standard Imaging Ionization Chambers	2 years
Standard Imaging Well Chambers	2 years
Standard Imaging Electrometers	2 years
Standard Imaging Software Products	1 year
All Other Standard Imaging Products	1 year
Standard Imaging Custom Product	90 days
Consumables	90 days
Serviced Product	90 days
Resale Products	As defined by the Original Equipment Manufacturer
ADCL Product CalibrationADCL Product Calibration (Standard Imaging uses the UW-ADCL for recalibrations required under warranty)	0 - 90 days = 100% of ADCL Calibration Costs 91 - 182 days = 75% of ADCL Calibration Costs 183 – 365 days = 50% of ADCL Calibration Costs 366 – 639 days = 25% of ADCL Calibration Costs (days from date of shipment to customer)

Standard Imaging's sole and exclusive obligation and the purchaser's sole and exclusive remedy under the above warranties are, at Standard Imaging's option, limited to repairing, replacing free of charge or revising labeling and manual content on, a product: (1) which contains a defect covered by the above warranties; (2) which are reported to Standard Imaging, Inc. not later than seven (7) days after the expiration date of the warranty period in the table; (3) which are returned to Standard Imaging, Inc. promptly after discovery of the defect; and (4) which are found to be defective upon examination by Standard Imaging Inc. Transportation related charges, (including, but not limited to shipping, customs, tariffs, taxes, and brokerage fees) to Standard Imaging are the buyer's responsibility. This warranty extends to every part of the product except consumables (fuses, batteries, or glass breakage). Standard Imaging, Inc. shall not be otherwise liable for any damages, including but not limited to, incidental damages, consequential damages, or special damages. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days.

This warranty is in lieu of all other warranties, express or implied, whether statutory or otherwise, including any implied warranty of fitness for a particular purpose. In no event shall Standard Imaging, Inc. be liable for any incidental or consequential damages resulting from the use, misuse or abuse of the product or caused by any defect, failure or malfunction of the product, whether a claim of such damages is based upon the warranty, contract, negligence, or otherwise.

This warranty represents the current standard warranty of Standard Imaging, Inc. Please refer to the labeling or instruction manual of your Standard Imaging, Inc. product or the Standard Imaging, Inc. web page for any warranty conditions unique to the product.